Catalogue no. 82-003-X
ISSN 1209-1367

Health Reports

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Release date: August 17, 2016

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... not applicable
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$0^s$ value rounded to 0 (zero) where there is a meaningful distinction between true zero and the value that was rounded
$^p$ preliminary
$^r$ revised
x suppressed to meet the confidentiality requirements of the *Statistics Act*
$^E$ use with caution
F too unreliable to be published
* significantly different from reference category ($p < 0.05$)

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Health Reports, Vol. 27, no. 8, pp. 12-18, August 2016 • Statistics Canada, Catalogue no. 82-003-X


# Acute care hospitalization, by immigrant category: Linking hospital data and the Immigrant Landing File in Canada

*by Edward Ng, Claudia Sanmartin and Douglas G. Manuel*


## Abstract

**Background:** Although immigrants tend to be healthier than the Canadian-born population when they arrive, subgroups, notably different immigration categories, may differ in health and health care use. Data limitations have meant the research has seldom focused on category of immigrant—economic, family or refugee. A newly linked database has made it possible to study acute care hospitalization by immigration category and source region.

**Data and methods:** The Immigrant Landing File–Hospital Discharge Abstract Linked Database (n = 2.6 million) was used to derive sex-specific crude and age-standardized hospitalization rates (ASHRs) per 10,000 population for all-cause and leading causes of hospitalization during the 2006/2007-to-2008/2009 period.

**Results:** Economic class immigrants had lower all-cause ASHRs than did their family class or refugee counterparts. Male refugees had high ASHRs overall and for circulatory diseases, digestive diseases, injury, and cancer. Female differences by immigrant category were less pronounced. All-cause ASHRs (excluding pregnancy) rose with years in Canada for male and female immigrants. Immigrants from East Asia had the lowest ASHRs; those from the United States, the highest.

**Interpretation:** Although hospital use is an imperfect indicator of health status, this study supports an initial healthy immigrant effect and its subsequent decline. Marked differences emerged among immigrant subgroups with some, notably refugees and immigrants from the United States, having significantly higher hospitalization rates overall and for leading causes, compared with other groups.


**Key words:** Data linkage, health care utilization, hospital records, immigrant health, refugees

When they arrive in Canada, immigrants tend to be in better health than the Canadian-born population.[1] However, the relationship between immigration and health is complex, and depends on a host of pre- and post-migration factors such as place of birth and reason for migration.[1] Two 2011 studies found substantial heterogeneity in health outcomes by source region and period of immigration.[2,3] Moreover, whether the health advantage prevails across immigration categories—refugee, economic and family—is not known.

Data about immigrant health outcomes are limited. Health administrative databases do not routinely record immigrant-related variables.[4] Population health surveys collect immigration information, but sample sizes are usually too small for birthplace-specific analyses. Linkages of census and health administrative information provide a basis for creating a database large enough for immigrant health research,[5,6] but the census lacks information about immigration category.

Linkage of the Immigrant Landing File (ILF) to health administrative information in the Discharge Abstract Database (DAD) overcomes some of these limitations in immigrant health research. Previously, a sample of the ILF was linked to health administrative data for the three major receiving provinces (British Columbia, Ontario and Quebec), and to mortality and cancer registry data across the country.[7-10] Individual provinces (for instance, Ontario and British Columbia) have also been involved in linking their health administrative data to the ILF.

This study reports the initial results of the recent ILF-to-DAD linkage—specifically, a bivariate overview of acute care hospitalization rates at the national level, by immigration category, landing year, and source world region.

## Data and methods

The ILF contains data on immigrants who arrived in Canada since 1980.[11] The information is from Immigration, Refugees and Citizenship Canada (IRCC; formerly, Citizenship and Immigration Canada) administrative files, and is provided to Statistics Canada annually. Landing records for 1980 through 2006 were used in this linkage.

The DAD contains information on hospital discharges, which the Canadian Institute for Health Information provides to Statistics Canada annually. Demographic, administrative and clinical data for acute care hospital discharges are available for all provinces and territories except Quebec (which does not routinely submit information to the DAD).[12] Each year, the DAD consolidates about 3 million records for hospitalizations occurring from April 1 through March 31 (fiscal year). Hospital discharges for 2006/2007 through 2008/2009 were used for this linkage.

The ILF-DAD linkage was accomplished through deterministic exact matching, with the 2006 Census of Population as a "bridge" file, and employed linkage keys created in two earlier projects in which the ILF and the DAD were separately linked to the 2006 Census. The 1980-to-2008 ILF was linked to the census using a hierarchical deterministic linkage based on variables common to both datasets (given and surname, date of birth, sex, postal code, landing year, country of birth, and mother tongue). The 2006/2007-to-2008/2009 DAD data were linked to the census using a hierarchical deterministic linkage based on birthdate, sex, and postal code.

A total of 2.6 million ILF records that linked to the 2006 Census were eligible for linkage to the DAD. Overall, 10% (n = 258,700) of ILF records linked to at least one

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DAD record for the 2006/2007-to-2008/2009 period. A validation study found that the linked file was representative of immigrants who arrived in Canada from 1980 through 2008 and their hospital experiences. Details about the linkage are available elsewhere.[13] The linkage was approved by Statistics Canada's Executive Management Board[14]; use of the linked data is governed by the *Directive on Record Linkage*.[15]

Statistics Canada ensures respondent privacy during the linkage and subsequent use of linked files. Only employees directly involved in the process have access to the unique identifying information required for linkage (such as name and sex) and do not access health-related information. When the data linkage is completed, an analytical file is created from which identifying information is removed. This de-identified file is accessed by analysts for validation and analysis.

## Study cohort

The ILF-DAD linked cohort was composed of 2,594,600 ILF records for new immigrants linked to 359,400 hospital discharges over the three years of follow-up.

## Variables

Immigrants were defined as economic, family or refugee class, according to the 2001 Immigration and Refugee Protection Act.[16] The economic class was further divided into principal applicants and dependants (spouse or children). The immigration categories examined in this analysis were: economic - principal applicant (including provincial nominees, available as of 1996); economic - dependant (including provincial nominees, available as of 1996); family (for family reunion purposes); refugee; and other (foreign nationals admitted on humanitarian and compassionate grounds, who do not qualify in any immigration category).

Landing year was used to classify immigrants as: established (1980s); medium-term (1990s); and recent (2000 through May 2006).

Source world regions were identified based on birthplace information in the ILF: United States; Caribbean/Central and South America; Western Europe; Eastern Europe; Sub-Saharan Africa; North Africa/Middle East/West Asia; South Asia; South East Asia; East Asia; and Oceania. Oceania (0.7% of total) was dropped from the world region analyses.

Limitations of the IRCC computer system in the late 1980s meant that some infants had been coded as centenarians at the time of entry. To remove false centenarians, the age of landers 100 or older was reduced by 100. Although this may have incorrectly modified the age of a few legitimate centenarians, a comparison of age information from the census with the age derived from this adjustment confirmed the validity of the correction.

## Statistical methods

Descriptive statistics were generated to profile the ILF cohort by sex. Annual crude and age-standardized hospitalization rates (ASHRs) were derived overall (with and without pregnancies) and for the four leading causes by sex. The total landing cohort population was the reference population for age standardization.

The primary outcome was inpatient acute care hospitalization from April 1, 2006 through March 31, 2009. Hospitalizations were classified by most responsible diagnosis, according to version 10 of the *International Classification of Diseases*.[17] The four leading causes were circulatory diseases (ICD-10 codes I00 to I93), cancer (C00 to D48), digestive diseases (K00 to K93), and injury (S00 to T93).

Because no Canadian-born comparison group was available in the ILF-DAD linked data, internally derived categories were used as reference groups: established immigrants (1980s); immigrants from the United States; and economic class principal applicants. Immigrants from the United States tended to have the highest ASHRs of all source regions. As well, an earlier analysis showed that the level of mortality among immigrants from the United States was similar to that of the Canadian-born population.[3]

Statistical testing for differences in age-standardized rates was based on a method that takes rare events into account.[18]

**Table 1**
**Percentage distribution of Immigrant Landing File cohort, by sex, age group, immigration category, landing year, and source world region**

| | Male | Female |
|---|---|---|
| **Total number** | 1,242,600 | 1,352,000 |
| **Mean age (2006)** | 38.6 | 39.4 |
| | % distribution | |
| **Age group (2006)** | | |
| 0 to 24 | 22.5 | 19.8 |
| 25 to 44 | 41.7 | 44.4 |
| 45 to 64 | 29.0 | 27.2 |
| 65 or older | 6.8 | 8.6 |
| **Immigration category** | | |
| Economic class | | |
| Principal applicant | 26.2 | 12.2 |
| Dependant | 23.5 | 33.7 |
| Family class | 28.9 | 37.4 |
| Refugee class | 16.4 | 12.7 |
| Other[1] | 5.0 | 4.0 |
| **Landing year** | | |
| 1980 to 1989 | 23.2 | 22.3 |
| 1990 to 1999 | 44.1 | 44.9 |
| 2000 to 2006 | 32.7 | 32.8 |
| **Source world region** | | |
| United States | 2.1 | 2.6 |
| Caribbean/Central and South America | 10.1 | 11.0 |
| Western Europe | 8.1 | 7.3 |
| Eastern Europe | 12.6 | 12.6 |
| Sub-Saharan Africa | 4.8 | 4.6 |
| North Africa/Middle East/West Asia | 9.4 | 7.7 |
| South Asia | 19.3 | 17.6 |
| South East Asia | 11.9 | 14.1 |
| East Asia | 20.7 | 21.8 |
| Oceania | 0.7 | 0.7 |

[1] foreign nationals admitted on humanitarian and compassionate grounds who do not qualify in any immigration category
**Note:** Excludes Quebec.
**Source:** Immigrant Landing File (1980 to 2006) linked to Discharge Abstract Database (2006/2007 to 2008/2009).

## Results

### Cohort description

About half (52%) of the 2.6 million immigrants in the linked dataset were females (Table 1). In 2006, the mean age of both sexes was 39, and more than 40% were in the 25-to-44 age range; 6% of men and 9% of women were aged 65 or older.

The family class accounted for 29% of male immigrants; another 26% were economic class principal applicants; and 24%, economic class dependants. Refugees comprised 16% of male immigrants. A much smaller percentage of female immigrants—12%—were economic class principal applicants; 37% were economic class dependants. The family class accounted for 37%, and 13% were refugees.

Fewer than a quarter (22% to 23%) were established immigrants (1980s); 45% were medium-term immigrants (1990s); and 33% were recent immigrants (2000 through 2006).

Four world regions accounted for almost two-thirds of male immigrants: East Asia (21%), South Asia (19%), Eastern Europe (13%), and South East Asia (12%). The corresponding percentages were similar for females, except that the third-ranking source was South East Asia (14%), not Eastern Europe (13%).

### All-cause hospitalization

Among male immigrants, the all-cause age-standardized hospitalization rate (ASHR) for the 2006/2007-to-2008/2009 period was 303 per 10,000 population (Table 2). Economic class principal applicants and dependants had a much lower all-cause ASHR (less than 265)

**Table 2**
**All-cause crude and age-standardized† acute care hospitalization rates (ASHRs) per 10,000 population, by sex, immigration category, landing year, and source world region, Immigrant Landing File cohort, 2006/2007 to 2008/2009**

| | All-cause hospitalization | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Male | | | | Female | | | | | | | |
| | | | | | Including pregnancy | | | | Excluding pregnancy | | | |
| | Crude rate | ASHR | 95% confidence interval | | Crude rate | ASHR | 95% confidence interval | | Crude rate | ASHR | 95% confidence interval | |
| | | | from | to | | | from | to | | | from | to |
| **Total** | 295.8 | 303.4 | 301.6 | 305.2 | 620.0 | 606.4 | 604.0 | 608.8 | 321.4 | 313.0 | 311.3 | 314.7 |
| **Immigration category** | | | | | | | | | | | | |
| Economic class | | | | | | | | | | | | |
| Principal applicant‡ | 275.8 | 263.6 | 250.7 | 277.1 | 545.5 | 586.6 | 557.8 | 616.9 | 286.6 | 297.3 | 281.1 | 314.5 |
| Dependant | 151.4 | 257.9 | 265.2 | 265.2 | 499.9 | 516.0* | 495.1 | 504.8 | 208.0 | 264.0* | 260.0 | 268.0 |
| Family class | 409.6 | 326.6* | 323.3 | 329.9 | 821.7 | 760.3* | 755.7 | 764.9 | 429.4 | 346.0* | 343.0 | 349.0 |
| Refugee class | 289.8 | 337.0* | 331.5 | 342.6 | 573.0 | 602.5 | 595.4 | 609.7 | 299.0 | 334.5* | 328.9 | 340.1 |
| Other§ | 427.9 | 355.5* | 347.4 | 363.8 | 649.6 | 608.6 | 596.3 | 621.2 | 432.9 | 356.2* | 347.3 | 365.3 |
| **Landing year** | | | | | | | | | | | | |
| 1980 to 1989‡ | 442.8 | 347.3 | 343.4 | 351.2 | 628.3 | 581.6 | 575.9 | 587.3 | 474.7 | 361.1 | 357.2 | 365.1 |
| 1990 to 1999 | 291.2 | 293.5* | 290.9 | 296.2 | 533.8 | 521.3* | 518.0 | 524.6 | 310.1 | 299.0* | 296.5 | 301.5 |
| 2000 to 2006 | 196.0 | 255.7* | 252.1 | 259.2 | 733.6 | 689.7* | 685.0 | 694.3 | 231.5 | 276.8* | 273.4 | 280.2 |
| **Source world region** | | | | | | | | | | | | |
| United States‡ | 465.0 | 463.7 | 448.5 | 479.4 | 730.0 | 786.5 | 768.8 | 804.7 | 483.5 | 503.1 | 489.1 | 517.5 |
| Caribbean/Central and South America | 303.6 | 344.0* | 337.6 | 350.6 | 708.2 | 696.4* | 688.7 | 704.1 | 405.3 | 400.5* | 394.6 | 406.4 |
| Western Europe | 420.6 | 409.2* | 402.1 | 416.5 | 710.9 | 684.9* | 675.5 | 694.4 | 475.7 | 432.0* | 424.8 | 439.4 |
| Eastern Europe | 300.0 | 330.6* | 324.9 | 336.4 | 547.3 | 549.2* | 542.8 | 555.7 | 304.1 | 304.5* | 299.7 | 309.3 |
| Sub-Saharan Africa | 299.3 | 358.1* | 347.9 | 368.6 | 764.9 | 753.5* | 740.9 | 766.3 | 350.1 | 386.6* | 377.0 | 396.4 |
| North Africa/Middle East/West Asia | 291.9 | 347.9* | 341.0 | 355.0 | 658.6 | 688.2* | 678.6 | 698.0 | 306.8 | 350.8* | 343.6 | 358.1 |
| South Asia | 316.9 | 327.2* | 322.9 | 331.5 | 757.6 | 719.2* | 713.1 | 725.4 | 319.4 | 322.7* | 318.4 | 327.0 |
| South East Asia | 254.3 | 262.1* | 257.3 | 267.0 | 572.7 | 557.7* | 551.6 | 563.9 | 291.1 | 273.8* | 269.6 | 278.1 |
| East Asia | 220.9 | 194.4* | 191.4 | 197.4 | 438.3 | 420.2* | 416.0 | 424.5 | 228.9 | 205.3* | 202.4 | 208.2 |

* significantly different from reference category ($p < 0.05$)
† standardized to overall immigrant landing cohort population
‡ reference category
§ foreign nationals admitted on humanitarian and compassionate grounds who do not qualify in any immigration category
**Note:** Excludes Quebec.
**Source:** Immigrant Landing File (1980 to 2006) linked to Discharge Abstract Database (2006/2007 to 2008/2009).

than did family class (327) or refugee class (337) male immigrants.

Recent male immigrants (2000 through 2006) had the lowest all-cause ASHR, at 256, compared with those who landed in the 1990s (294) or the 1980s (347). The ASHR was lowest for immigrants from East Asia (194) and highest for those from the United States (464).

Among female immigrants, all-cause ASHRs including and excluding pregnancy-related admissions were 606 and 313 per 10,000 population, respectively. With or without pregnancy, family class female immigrants had high ASHRs (760 and 346), compared with economic class principal applicants (587 and 297). Excluding pregnancy, female refugees also had a high all-cause ASHR (335).

Compared with those who landed in the 1990s or 1980s, recent female immigrants (2000 through 2006) had the highest ASHR when pregnancy was included (690), but the lowest when pregnancy was excluded (277). By world region, female immigrants from the United States had the highest ASHRs, with or without pregnancy (787 and 503, respectively), and those from East Asia, the lowest (420 and 205).

## Leading causes

The four leading causes of hospitalization for male immigrants were circulatory diseases (60 per 10,000 population), digestive diseases (48), injury (32), and cancer (28) (Table 3). By immigration category, male refugees had higher ASHRs for the four leading causes than did economic class principal applicants. For each of these causes, a pattern of rising ASHRs with time in Canada was evident. Male immigrants from Asia, particularly East Asia, had low ASHRs for each cause. South Asians had the lowest ASHR for cancer (20), but a high ASHR for circulatory diseases (81).

**Table 3**
**Crude and age-standardized† acute care hospitalization rates (ASHRs) per 10,000 population for four leading causes, by immigration category, landing year, and source world region, male Immigrant Landing File cohort, 2006/2007 to 2008/2009**

| | Circulatory diseases | | | | Digestive diseases | | | | Injury | | | | Cancer | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Crude rate | ASHR | 95% confidence interval from | to | Crude rate | ASHR | 95% confidence interval from | to | Crude rate | ASHR | 95% confidence interval from | to | Crude rate | ASHR | 95% confidence interval from | to |
| **Total** | 58.2 | 60.1 | 59.3 | 60.9 | 47.6 | 48.3 | 47.6 | 49.0 | 31.2 | 31.5 | 30.9 | 32.1 | 27.5 | 28.2 | 27.7 | 28.8 |
| **Immigration category** | | | | | | | | | | | | | | | | |
| Economic class | | | | | | | | | | | | | | | | |
| Principal applicant‡ | 60.9 | 57.0 | 51.6 | 62.9 | 46.1 | 43.0 | 37.7 | 48.9 | 25.1 | 27.1 | 21.1 | 34.7 | 32.5 | 28.1 | 27.0 | 29.3 |
| Dependant | 17.0 | 49.7* | 46.4 | 53.3 | 30.4 | 42.7 | 40.1 | 45.4 | 25.0 | 28.3 | 26.4 | 30.4 | 10.5 | 26.8 | 24.4 | 29.4 |
| Family class | 85.5 | 64.2* | 62.7 | 65.6 | 58.4 | 50.4* | 49.1 | 51.8 | 37.2 | 34.3* | 33.2 | 35.4 | 36.2 | 27.7 | 26.7 | 28.6 |
| Refugee class | 54.4 | 67.6* | 65.0 | 70.2 | 49.0 | 53.3* | 51.3 | 55.5 | 36.2 | 38.1* | 36.4 | 39.8 | 25.0 | 30.3* | 28.6 | 32.1 |
| Other§ | 91.6 | 70.4* | 67.0 | 73.8 | 66.8 | 57.3* | 54.1 | 60.8 | 40.1 | 38.0* | 35.2 | 41.1 | 37.8 | 29.7 | 27.6 | 32.1 |
| **Landing year** | | | | | | | | | | | | | | | | |
| 1980 to 1989‡ | 96.8 | 68.5 | 67.0 | 70.1 | 65.5 | 55.1 | 53.5 | 56.8 | 40.6 | 37.9 | 36.5 | 39.4 | 44.0 | 31.7 | 30.7 | 32.8 |
| 1990 to 1999 | 57.0 | 57.3* | 56.2 | 58.5 | 46.7 | 46.9* | 45.9 | 48.0 | 30.8 | 30.8* | 30.0 | 31.7 | 26.9 | 27.0* | 26.2 | 27.8 |
| 2000 to 2006 | 32.1 | 52.4* | 50.7 | 54.2 | 35.9 | 42.3* | 41.0 | 43.7 | 24.9 | 26.1* | 25.1 | 27.2 | 16.3 | 24.9* | 23.8 | 26.1 |
| **Source world region** | | | | | | | | | | | | | | | | |
| United States‡ | 85.3 | 85.0 | 78.7 | 91.8 | 70.2 | 70.2 | 64.4 | 76.5 | 48.4 | 49.2 | 44.3 | 54.7 | 40.1 | 39.0 | 34.9 | 43.7 |
| Caribbean/Central and South America | 57.2 | 68.6* | 65.6 | 71.6 | 52.0 | 55.7* | 53.2 | 58.3 | 33.3 | 34.9* | 32.9 | 36.9 | 25.8 | 29.9* | 28.0 | 31.9 |
| Western Europe | 79.9 | 76.3* | 73.2 | 79.4 | 63.9 | 62.2* | 59.4 | 65.0 | 50.2 | 50.0 | 47.5 | 52.6 | 39.3 | 36.9 | 34.9 | 39.1 |
| Eastern Europe | 62.1 | 71.0* | 68.3 | 73.7 | 51.2 | 53.7* | 51.5 | 56.0 | 36.3 | 37.4* | 35.6 | 39.3 | 33.9 | 38.5 | 36.5 | 40.5 |
| Sub-Saharan Africa | 51.8 | 68.6* | 63.9 | 73.5 | 43.4 | 50.1* | 46.4 | 54.0 | 36.1 | 38.4* | 35.4 | 41.7 | 23.6 | 29.6* | 26.7 | 32.8 |
| North Africa/Middle East/West Asia | 60.1 | 79.1 | 75.7 | 82.7 | 51.7 | 57.9* | 55.2 | 60.7 | 31.2 | 32.4* | 30.4 | 34.5 | 23.6 | 29.6* | 27.6 | 31.8 |
| South Asia | 77.3 | 81.4 | 79.2 | 83.5 | 46.4 | 47.1* | 45.6 | 48.8 | 29.0 | 29.5* | 28.2 | 30.8 | 19.0 | 19.9* | 18.8 | 20.9 |
| South East Asia | 45.9 | 47.2* | 45.2 | 49.3 | 43.8 | 44.5* | 42.6 | 46.6 | 24.4 | 24.9* | 23.5 | 26.5 | 27.8 | 28.2* | 26.6 | 29.8 |
| East Asia | 32.7 | 27.6* | 26.6 | 28.8 | 36.3 | 33.1* | 31.9 | 34.4 | 21.5 | 20.1* | 19.2 | 21.1 | 29.0 | 25.1* | 24.1 | 26.2 |

* significantly different from reference category ($p < 0.05$)
† standardized to overall immigrant landing cohort population
‡ reference category
§ foreign nationals admitted on humanitarian and compassionate grounds who do not qualify in any immigration category
**Note:** Excludes Quebec.
**Source:** Immigrant Landing File (1980 to 2006) linked to Discharge Abstract Database (2006/2007 to 2008/2009).

Among female immigrants, the four leading causes of hospitalization (other than pregnancy-related) were the same as for male immigrants, but the rank order of ASHRs differed: cancer (47), digestive diseases (39), circulatory diseases (32), and injury (25) (Table 4). Female economic class principal applicants had low ASHRs for digestive diseases (35) and injury (21), compared with refugees (43 and 27, respectively), but a higher ASHR for cancer (54) than did females in the refugee (45), economic dependant (45), and family classes (46). ASHRs rose with years in Canada. Except for cancer, ASHRs among East Asian females were low. By contrast, South Asian females had a low ASHR for cancer, but a high ASHR for circulatory diseases.

## Discussion

Linkage of the ILF with hospital data makes national-level (excluding Quebec) analysis by immigration category possible. Refugees tended to have high all-cause ASHRs (excluding pregnancy), and among males, for the four leading causes. These individuals have been forced out of their home country, and are usually not as healthy as those who migrate voluntarily. The pre-migration risk factors that may contribute to their less favourable health status include the stress of war, physical and sexual abuse, and hardships encountered in refugee camps such as poor sanitation and nutrition and lack of medical care.[19-23] After arriving in Canada, refugees may face delays in securing health coverage, difficulties with language, finances and transportation, and lack of knowledge of the health care system.[19-23] The possibility that the high ASHRs among refugees reflect less use of health services such as primary care physicians could be examined by linking ILF data to provincial health care information, such as that available in Ontario.

**Table 4**
**Crude and age-standardized[†] acute care hospitalization rates (ASHRs) per 10,000 population for four leading causes, by immigration category, landing year, and source world region, female Immigrant Landing File cohort, 2006/2007 to 2008/2009**

| | Cancer | | | | Digestive diseases | | | | Circulatory diseases | | | | Injury | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 95% confidence interval | | | | 95% confidence interval | | | | 95% confidence interval | | | | 95% confidence interval | |
| | Crude rate | ASHR | from | to | Crude rate | ASHR | from | to | Crude rate | ASHR | from | to | Crude rate | ASHR | from | to |
| **Total** | 47.6 | 46.7 | 46.1 | 47.4 | 39.7 | 38.9 | 38.3 | 39.5 | 34.1 | 32.2 | 31.6 | 32.7 | 25.2 | 24.6 | 24.1 | 25.0 |
| **Immigration category** | | | | | | | | | | | | | | | | |
| Economic class | | | | | | | | | | | | | | | | |
| Principal applicant[‡] | 66.1 | 54.2 | 52.1 | 56.4 | 34.8 | 35.4 | 30.0 | 41.8 | 22.2 | 32.4 | 26.0 | 40.4 | 20.1 | 21.1 | 17.2 | 25.7 |
| Dependant | 35.1 | 44.9* | 43.4 | 46.5 | 28.9 | 34.9 | 33.5 | 36.3 | 11.8 | 21.5* | 20.1 | 23.0 | 17.6 | 21.9 | 20.8 | 23.1 |
| Family class | 52.2 | 45.5* | 44.4 | 46.5 | 49.8 | 41.0 | 40.0 | 42.1 | 59.4 | 36.8 | 35.9 | 37.6 | 32.2 | 25.2 | 24.4 | 26.0 |
| Refugee class | 42.9 | 45.4* | 43.5 | 47.4 | 39.2 | 43.3* | 41.4 | 45.4 | 24.2 | 33.7 | 31.7 | 35.7 | 24.6 | 26.9* | 25.4 | 28.5 |
| Other[§] | 66.0 | 56.2 | 52.8 | 59.8 | 52.1 | 44.7* | 41.6 | 48.1 | 50.5 | 32.7 | 30.4 | 35.2 | 39.1 | 30.4* | 27.9 | 33.1 |
| **Landing year** | | | | | | | | | | | | | | | | |
| 1980 to 1989[‡] | 67.8 | 52.0 | 50.6 | 53.5 | 56.5 | 44.7 | 43.3 | 46.2 | 61.7 | 36.6 | 35.6 | 37.7 | 39.4 | 29.7 | 28.5 | 30.9 |
| 1990 to 1999 | 49.8 | 48.1* | 47.2 | 49.1 | 38.2 | 37.1* | 36.3 | 38.0 | 33.5 | 31.0* | 30.3 | 31.8 | 23.4 | 22.7* | 22.0 | 23.4 |
| 2000 to 2006 | 30.6 | 38.7* | 37.4 | 40.0 | 30.3 | 36.0* | 34.8 | 37.2 | 15.9 | 26.7* | 25.6 | 27.9 | 17.8 | 21.3* | 20.4 | 22.3 |
| **Source world region** | | | | | | | | | | | | | | | | |
| United States[‡] | 52.5 | 52.5 | 48.2 | 57.3 | 63.7 | 65.8 | 60.9 | 71.1 | 40.6 | 44.4 | 40.3 | 49.0 | 43.2 | 45.5 | 41.4 | 50.0 |
| Caribbean/Central and South America | 62.2 | 60.2* | 58.0 | 62.5 | 52.5 | 52.1* | 50.1 | 54.3 | 46.2 | 45.7 | 43.8 | 47.7 | 25.0 | 24.9* | 23.4 | 26.4 |
| Western Europe | 57.6 | 52.1 | 49.6 | 54.6 | 58.3 | 54.2* | 51.7 | 56.9 | 52.1 | 42.9 | 40.8 | 45.1 | 47.1 | 43.1 | 40.9 | 45.5 |
| Eastern Europe | 50.1 | 49.3 | 47.4 | 51.2 | 40.6 | 40.7* | 39.0 | 42.5 | 34.9 | 35.6* | 34.0 | 37.4 | 25.7 | 25.8* | 24.4 | 27.2 |
| Sub-Saharan Africa | 50.9 | 55.5 | 52.0 | 59.3 | 42.5 | 46.3* | 43.1 | 49.8 | 26.6 | 34.4* | 31.4 | 37.6 | 28.6 | 32.6* | 29.9 | 35.6 |
| North Africa/Middle East/West Asia | 37.2 | 44.0* | 41.5 | 46.6 | 40.4 | 44.4* | 41.9 | 47.0 | 28.6 | 38.8 | 36.3 | 41.5 | 24.0 | 27.1* | 25.2 | 29.2 |
| South Asia | 35.2 | 36.4* | 35.0 | 37.9 | 34.0 | 34.3* | 32.9 | 35.7 | 39.9 | 40.7 | 39.2 | 42.3 | 22.0 | 22.2* | 21.1 | 23.3 |
| South East Asia | 51.6 | 47.3* | 45.6 | 49.0 | 37.3 | 35.4* | 33.9 | 36.9 | 30.2 | 27.5* | 26.2 | 28.8 | 18.8 | 17.9* | 16.8 | 19.0 |
| East Asia | 44.8 | 41.8* | 40.5 | 43.1 | 28.1 | 25.2* | 24.2 | 26.2 | 20.7 | 16.0* | 15.3 | 16.8 | 20.6 | 18.1* | 17.3 | 19.0 |

* significantly different from reference category ($p < 0.05$)
† standardized to overall immigrant landing cohort population
‡ reference category
§ foreign nationals admitted on humanitarian and compassionate grounds who do not qualify in any immigration category
**Note:** Excludes Quebec.
**Source:** Immigrant Landing File (1980 to 2006) linked to Discharge Abstract Database (2006/2007 to 2008/2009).

Economic class principal applicants generally had low ASHRs. However, the ASHR for cancer was relatively high among female principal applicants. A pilot linkage of Manitoba health care data with the ILF also found high hospitalization rates among female economic class immigrants.[24]

## *What is already known on this subject?*

- While immigrants tend to have better health on entry to Canada, it is not clear if this health advantage is shared across source countries and by immigrant category (refugee, economic, family).
- Immigrant information is lacking in provincial and territorial health data and at the national level.
- Surveys include immigration variables, but sample sizes are usually not large enough for birthplace-specific analyses.
- Linkage of census and health administrative information has created databases of sufficient size for the analysis of immigrant-related variables.

## *What does this study add?*

- Linkage of the Immigrant Landing File to the Discharge Abstract Database makes it possible to analyze immigrant hospitalization at the national level.
- Initial results of this linkage generally corroborate other research on the health of immigrants, and provide additional insights by immigrant category.
- Refugees of both sexes had high all-cause (excluding pregnancy) age-standardized hospitalization rates (ASHRs), compared with economic class immigrants. For males, this was also true for the four leading causes of hospitalization.
- A high ASHR for cancer among female economic class principal applicants warrants further study.

In-depth multivariate analysis is needed to examine different subcategories of refugees (government-assisted, privately sponsored, or those landed in Canada) and economic class immigrants (business, skill or provincial nominee) by variables such as birthplace, period of immigration, and official language ability. Additional linkages to tax data would provide opportunities to study the impact of the extent of labour market integration on health care use, and associations between hospitalization and labour market outcomes.

The rise in ASHRs with years in Canada supports an initial "healthy immigrant effect" and its subsequent decline. This gradient was observed for all-cause hospitalization and for the leading causes. However, the gradient could also reflect the shift in source countries from Europe to Asia. It is possible that recent immigrants have lower hospitalization rates because those who landed since 2000 were more likely to be from Asia, among whom ASHRs tend to be low. Nonetheless, the previous census-mortality linkage study also found a decline in the healthy immigrant effect over time, regardless of world region of origin.[3]

ASHRs among immigrants from East Asia and South East Asia were consistently low. This corroborates the results of a linkage study that found low rates of hospitalization and physician visits among these groups in Ontario and British Columbia.[25] A census-based national study also reported a low overall mortality rate and low cardiovascular and cancer mortality rates among these groups.[3]

By contrast, ASHRs for circulatory diseases were high among South Asian immigrants of both sexes. Other studies,[26-28] too, have reported elevated rates of circulatory diseases among South Asians.

## Limitations

Hospital use is an imperfect indicator of health status. As well, a low hospitalization rate is not a proxy for health advantage. The dataset does not contain information on the use of primary care; in Canada, physician care, home care and long-term care, which indicate the need for medical attention, are key alternatives to hospitalization. A higher hospitalization rate for certain immigrant groups could reflect less access to or inefficient use of primary care systems.

In the absence of information about the Canadian-born in the dataset, immigrants from the United States were used as the reference group for this analysis (Tables 2 to 4). An alternative would be to use information from the census-DAD linked database for comparison.

## Conclusions

The ILF-DAD linkage demonstrates the value of using the results of previous linkages to create new data sources for immigrant health research. The findings of this analysis generally corroborate those of previous studies, and add information about immigration category. Refugees had high ASHRs, compared with economic class immigrants (excluding pregnancy). For males, this was also true for the four leading causes of hospitalization. The high ASHR for cancer among female economic class principal applicants warrants further investigation.

In 2011, immigrants made up one-fifth (20%) of Canada's population,[29] a figure expected to reach at least 25% by 2031.[30] The trend toward increased immigration emphasizes the value of this linked dataset in providing a comprehensive picture of the health and health service use of various immigrant groups. ■

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